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THE USE OF LIME IN POTATO PRODUCTION IN EASTERN VIRGINIA

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In connection with the control of certain potato diseases (14, 22) lime has been excluded or used very sparingly in potato production in many sections. The hydrogen ion concentration of the soils was not subject to any great change, however, previous to 1925 (16) because the fertilizing materials added to the soil were either basic or only slightly physiologically acid. The continuous use of (16) the distinctly physiologically acid fertilizers which came on the market about 1925 has resulted in many soils becoming more acid each year. This, no doubt, has been a contributing factor to depressed crop yields in some sections. It is noted that during the five year period 1925-1929 the average yield of potatoes on the Eastern Shore of Virginia (19) was 160 bushels per acre as compared with 135 bushels for the next five year period. In the Norfolk section the yield was 135 bushels as compared with 149 bushels per acre for the same two periods. Lime has been more generally applied to the potato soils in the Norfolk section. This is brought out by the fact that for several thousand soil tests (7) made on potato soils from 1932 to 1934 more than 40 per cent of the Eastern Shore soils tested below pH 5.0 whereas only 28 per cent tested below pH 5.0 in the Norfolk area. From these facts it can hardly be questioned that excess soil acidity has been a factor in reducing crop yields on the Eastern Shore. Since more than 45,000 acres of early potatoes are planted annually this becomes an economic factor of great importance.

SOIL FACTORS AND EARLY POTATO PRODUCTION

With the present keen competition in potato production the soil requirements are most exacting. Factors other than just a large yield are important. A soil upon which a crop is grown greatly influences

the following qualities of the potato: earliness, shape, size, color, texture, keeping quality, cooking quality, etc. Consequently, soil conditions that influence these factors should be given consideration.

The early potato producing area lies within the Coastal Plain province, a physiographic division extending along the Atlantic Ocean from Long Island to southern Florida and around the Gulf of Mexico to the mouth of the Rio Grande (21). The chief soil-forming materials of the Coastal Plain soils in eastern Virginia are sand and silt. Sand is the dominant constituent of most of the soils in this area. Generally silt is the main constituent of the loam soils bordering the "Necks" on the Chesapeake Bay. The underlying or substratum material, lying usually about three feet below the surface, is made up of coarser material than the top soil. This improves the drainage of the soil and makes the soils well adapted to vegetable crops.

Several soil types found in this area are probably better adapted to early potato production than other soil types, namely the well drained fine sands, sandy loams, and fine sandy loams. Potatoes grown on fertile soils of these types are noted for their excellent quality (12); they present an attractive appearance due to their smooth glossy skins; carry well in transit; and become mealy instead of soggy when boiled or baked. These soils even in the virgin state, are naturally low in organic matter, the destruction of which is greatly limited by cultivation. Therefore, many soils that once produced bumper crops no longer do so due principally to neglect to maintain the soil organic matter content and soil reaction to a point suited to the requirements of the potato plant.

Many soils that, because of a poor physical condition and poor drainage, are naturally higher in organic matter content, are now frequently being planted to vegetable crops in preference to the naturally better adapted soils. This, however, is being done at the expense of quality for quantity production.

The soil solution must carry a well balanced nutrient supply for the maximum production (3, 5, 25) of quality potatoes. The calcium and the magnesium supply of the soil are important. Potash, phosphorus, and nitrogen are added in the fertilizer, but a large part of the calcium and magnesium in the soil must be supplied from liming materials. These elements in addition to utilization by the plant also condition the soil for the maximum utilization of the fertilizer added. Since soils commonly used for potatoes have a high power for fixing phosphorus (6, 9, 11) in a difficultly available state, this becomes a problem of great significance. The average crop will utilize from 12 to 15 pounds of phosphoric acid per acre and the general practice is to add

from 100 to 150 pounds per acre in the fertilizer, thus a better utilization is greatly to be desired. Very little of the added phosphorus is leached but very little remains available for subsequent crops. Indeed, it is questionable whether the current crop gets sufficient phosphorus for maximum growth on soils that are very acid or low in organic matter. Both these factors (6, 9, 11) greatly influence the availability of phosphorus.

The Movement of Lime in the Soil

To influence the acidity of the soil properly a liming material must be thoroughly mixed with the soil. This point is well brought out in the data presented in table 1. A Norfolk sandy loam soil was limed with hydrated calcium lime in January, 1932. The maximum application was practically sufficient to neutralize the acidity of the first five or six inches, or ploughed area, of soil. A check of the pH value of the first nine inches of the soil showed that the lower 3 or 4 inches had been affected only slightly. A study of the replaceable calcium showed that very little calcium had stopped in the A_2 or 9 to 12 inch horizon, but a large quantity had moved downward to the B or 12 to 24 inch horizon. This shows that as the calcium moves downward into the soil it goes principally as soluble salts (sulfates, chlorides, and nitrates) and not in a form that readily neutralizes the colloidal acids. The fact that the B horizon in the heavily limed plat carried about twice the calcium content of the no-limed plat, with very little change in the hydrogen ion concentration of the soil, indicates that the calcium must have been there in the form of soluble salts and not primarily held by the colloidal acid. The neutralization (2) would be effective over a period of years, however. Since calcium carbonate is soluble only to the extent of about one part in 10,000 parts of water, the movement downward into the soil in this form must be very slow. Many growers feel that lime readily leaches down into the soil and neutralizes the soil acidity. This feeling frequently leads to disappointments in the immediate benefits from liming.

Seasonal Variations in pH Readings in Field Soils

Since lime is generally recommended on the basis of the pH value of the soil, factors that influence the soil reaction are important. Field soils generally show a difference in pH readings from winter to summer (10, 20). Potato soils taken under similar conditions of field

TABLE 1.—*The influence of hydrated lime upon the movement of calcium in the soil*
(Norfolk Sandy Loam)

Plat No.	1/25/32	6/18/34							
	Pounds Lime* Applied	pH Plowed Surface	A_1 0-9 Inches		A_2 9-12 Inches		B 12-24 Inches		0-24 Inches Total* Replaceable
			pH	Replaceable Lime*	pH	Replaceable Lime*	pH	Replaceable Lime*	
1	none	4.2	4.3	714	4.3	224	4.5	1120	2058
2	926	4.4	4.5	882	4.4	238	4.5	1428	2548
3	1852	5.2	4.9	1260	4.6	238	4.6	1652	3150
4	2778	5.3	5.2	1953	4.6	343	4.5	2016	4312
5	3704	5.8	5.5	2373	4.5	252	4.6	2016	4641
6	4630	6.0	5.5	2520	4.6	308	4.5	2016	4844
7	7408	6.8	5.7	2667	4.6	315	4.6	2212	5194

*Pounds of CaO per acre.

moisture generally vary from 0.5 to 0.6 of a pH reading in eastern Virginia. These data are given in table 2. This difference may be even greater under different moisture conditions. Soils generally test less acid following heavy rains than after the soil has dried out in the field. From the data given in table 2 it is evident that soils that test, for instance, pH 5.0 in winter are likely to be acid enough in late spring and summer to affect the yield of potatoes considerably.

TABLE 2.—*Seasonal variations in pH readings in field soils*

Fourteen Composite* Samples	July 1932	Dec. 1932	June 1933	Jan. 1934	July 1934	Jan. 1935	July 1935
Mean pH	4.55	5.01	4.47	4.93	4.40	4.84	4.24
Average variation	0.11	0.10	0.10	0.07	0.07	0.17	0.06

*A composite of from 15 to 20 borings in the plowed area of soil.
pH by quinhydrone procedure.

During the process of oxidation of organic matter in the soil and the change of protein and ammonia compounds to nitrate nitrogen certain acids are formed. The principal acids formed are nitric, sulfuric, and hydrochloric. These acids are neutralized by the bases in the soil and absorbed by the plant or leached away by rain. This conclusion is supported by the data given in table 3. The change in pH value of the Sassafras sandy loam soil was about 0.5 of a pH unit. The nitric acid content was about twice as high in July as it was in December. Several factors are responsible for this difference in nitrate formation: (1) while the rainfall is fairly uniform for all seasons, at Onley, leaching is more pronounced in winter, because evaporation is much less; (2) nitrates form in the soil about ten times more rapidly at 25° C, than at 10° C, which is about the difference found in the mean monthly temperatures mentioned in table 3. The sulfate and chloride content was also higher in summer than winter. The soil was leached until the easily soluble salts were removed and the pH value again taken. These data show that under these conditions the soil had a tendency to come back to a pH value higher than that found in winter. This indicates that if the soil samples had been taken after a heavy rain the pH reading would have been about 0.5 higher. Therefore, the time and conditions under which the soil samples are taken are very important points to be considered.

LIME EXPERIMENT—ONLEY, VIRGINIA

Thirty-eight plats 15 by 200 feet were used to test the effect of six

different kinds of lime: 1, hydrated calcium (69.3% CaO, 1.4% MgO), 2, hydrated dolomitic (40.4% CaO, 32.9% MgO), 3, calcium limestone (53.4% Ca.O, 1.0% MgO), 4, dolomite (30.1% CaO, 20.7% MgO), 5, oyster shell (48.2% CaO, 0.7% MgO), 6, marl lime (50.0% CaO, 1.0% MgO), upon the soil reaction, available calcium and magnesium and crop yield.

The plats were so arranged that an untreated plat followed each of the two treated plats. The soil is a sassafras sandy loam grading into a Keyport sandy loam at the extreme southern edge. The organic matter content of the soil varied somewhat in different parts of the field but averaged about 2.8 per cent. The initial application of lime was made in January, 1932 on the basis of 1000 and 2000 pounds of calcium carbonate, or Mg and Ca carbonate. A second 1000 pound application was made on the 1000 pound plats in October 1934.

Calcium and Magnesium Supply and Soil Factors

The calcium and magnesium supply of many very acid potato soils is very low. The data given in table 4 point out the great influence that a comparatively light application of lime may have upon the replaceable calcium and magnesium in the soil. Dolomitic lime, the equivalent of 1000 pounds of calcium carbonate, doubled the magnesium supply of the soil. An application equivalent to 2000 pounds of calcium carbonate almost tripled the original amount of magnesium. The calcium supply was increased but not in proportion to the magnesium, principally because the original calcium content was higher and that leaching and plant utilization were higher than for magnesium.

Quality of Lime and Soil Reaction

The rapidity of the reaction of a liming material with the soil acids is a very important factor. The rapidity of the reaction of a ground limestone with a soil depends largely upon the degree of fineness to which the material has been processed (1, 24). Hydrated limes react more rapidly with the soil because they are very fine and more quickly soluble.

The degree of fineness and the reaction with the soil are shown in table 5. These data show that the hydrated and finely processed lime-

TABLE 3.—*Factors that influence the hydrogen ion concentration of the soil*

1932	(H^+) Normal * Soil	(H^+) Leached Soil	Parts Per Million		
			Nitric Acid	Sulphuric Acid	Hydrochloric Acid
December	0.73×10^{-5} (pH 5.14)	0.34×10^{-5} (pH 5.48)	76	122	1.3
July	0.23×10^{-4} (pH 4.67)	0.37×10^{-4} (pH 5.44)	156	147	1.9

*Average of 10 composite samples from 15 to 20 borings. Quinhydrone procedure for pH.

TABLE 4.—*The influence of lime upon the available calcium and magnesium in the soil*

Lime Applied January, 1932 Pounds per Acre	Available* June, 1933 Pounds per A/6 Inches	
	CaO	MgO
No lime	784	124
1000 equivalent to $CaCO_3$ dolomitic	980	248
1000 equivalent to $CaCO_3$	1,147	124
2000 equivalent to $CaCO_3$ dolomitic	1,243	336
2000 equivalent to $CaCO_3$	1,412	132

*Replaceable with neutral salt.

TABLE 5.—*The influence of the quality of lime upon soil reaction*

Kind of Lime Applied	Per Cent through 100-mesh Sieve	Mean pH 1000-pound Application January, 1932—October, 1934		
		July, 1932	June, 1933	July, 1935
No lime		4.55	4.47	4.26
Hydrated (calcium)	100	5.45	4.97	4.90
Hydrated (dolomitic)	100	5.30	4.93	4.95
Marl	31	4.65	4.82	4.73
Oyster shell	77	5.20	4.82	4.90
Limestone (dolomitic)	90	4.90	4.87	4.93
Limestone (calcium)	85	5.15	4.80	4.80

stones had affected a greater change in the soil reaction over the first six-month period than the coarse limestone. Over a period of a year and a half, however, the reaction of all the limed soils had reached about the same equilibrium.

Since the degree of fineness of lime greatly influences the rate of reaction in the soil, the finely processed limes should be used if immediate results are desired. This is clearly brought out in table 6. The finely processed limes gave the largest increase in yield the season following the time they were applied. Further, the yield increase was greater in 1935 as a result of the previous fall application than was the 1933 yield as a result of the January, 1932, application.

Lime and Crop Yield

The previous discussion has shown that over a period of two years, the different kinds of lime, when used in equivalent quantities, have influenced the soil reaction about an equal amount. Therefore, the results presented over a period of years resolve themselves into the effect of calcium and dolomitic lime upon the crop yield. These results are presented in table 7. Probably it should first be mentioned that the pH readings given were taken at the harvest of the respective potato crops. The pH value of the soil at the time the potatoes were planted was about 0.5 of a pH unit higher than at harvest time. The pH value of the soil during a part of the growing season was higher than indicated in the table. This, of course, is a very important factor in explaining the high yields in the 1934 and 1935 crops on comparatively very acid soils.

The yields in 1932 and 1935 have already been discussed but a summary is given here. The 1932 yields were very poor due to an extremely unfavorable dry season. Even under these conditions, however, the increases in yield were quite significant. The dolomitic lime gave the greatest increases in yield on the average.

The yields in 1933 were much better because of a more favorable season. The difference in yield resulting from the use of the calcium and the dolomitic limes was small. The plants on all plats received sufficient magnesium to make full growth, because a very heavy crop of sorghum was turned under in the fall of 1932. This decomposing organic matter no doubt furnished abundant soluble magnesium for the crop.

The greatest increase in yield, as high as 64 per cent in 1934, was shown three years after the application of lime. This crop followed lima beans in the fall of 1933. The lima beans, however, due to unfavorable weather conditions and acid soil made very poor growth and, therefore, furnished very little organic matter. From this standpoint, then, the liming materials were better evaluated. The yields on the dolomitic lime plats were far better than the ones on the high calcium lime plats. The plants on the check and high-calcium limed plats showed evidence of magnesium deficiency.

The crop yields for 1935 are particularly interesting from the standpoint that a second application of lime was made to the 1000 pound treated plats, bringing the total application on all limed plats up to 2000 pounds within 4 years. It might be stated here that the average potato soil found on the Eastern Shore would not produce a crop on a soil with a pH value as low as 4.2. The organic matter content of

TABLE 6.—*The influence of lime on soil reaction and crop yield in* 1932 *and* 1935

Lime Added	pH	1000-pound Application Increase over Check, July, 1932		pH	2000-pound Application Increase over Check, July, 1932		pH	2nd 1000-pound Application Increase over Check, July, 1935	
		Bushels Acre	Per Cent		Bushels Acre	Per Cent		Bushels Acre	Per Cent
Hydrated (calcium)	5.45	7	8.2	5.55	14	16.4	4.90	62	25.9
Hydrated (dolomitic)	5.30	22	25.8	5.80	22	25.8	4.95	55	23.0
Marl	4.65	0	0.0	4.80	4	4.7	4.73	26	10.9
Oyster shell	5.20	17	20.0	5.35	21	24.7	4.90	50	20.9
Limestone (dolomitic)	4.90	2	2.3	5.20	17	20.0	4.93	52	21.8
Limestone (calcium)	5.15	1	1.2	5.50	17	20.0	4.80	63	26.4

this soil analyzed 2.8 per cent whereas the average Eastern Shore soil would be much below that figure.

Discussion

Experimental evidence (4, 8, 15, 22) elsewhere and at this Station has shown that potatoes do best between pH values of 5.0 and 5.5. Below these reactions unfavorable soil conditions (aluminum toxicity, high phosphate fixation, low calcium and magnesium supply, etc.), adversely affect the yield. Above these reactions such other unfavorable conditions as scab organisms, (14, 22) etc., greatly influence the appearance and yield of potatoes. This leaves a rather narrow limit within which soils must be maintained to insure the best crop.

Inference was made in the beginning of this paper that many potato soils are becoming quite acid for the production of potatoes. Indeed, it is very likely that this has been a great factor in the reduction in yield noted in the last five years on the Eastern Shore. Because of the more acid-forming materials used in the fertilizer the soils have required special attention in order to maintain the best reaction for the crop grown. While the results cited are very striking, they would have been even more pronounced on the average Eastern Shore soil, because the particular soil used in this experiment carried a good organic matter content and a soil improvement crop followed potatoes. The original high organic content of the soil and the additional organic material turned under each year increased the amount of available phosphorus and reduced the toxic aluminum content on the unlimed soils.

Several factors in the soil greatly affect the availability of phosphorus, magnesium and the presence of toxic aluminum (6, 7, 9, 10, 13). One of the distinct advantages of organic matter in potato soils is to hold phosphorus in an available state. Organic matter greatly suppresses the ionization and solubility of aluminum in the soil. Soluble aluminum, aside from being toxic to plant growth, also removes phosphorus from the soil solution. Thus, it is evident that a soil with a high organic matter content will grow plants (6, 9) at a lower pH value than the same soil with a low organic matter content. Many soils found in the Coastal Plain will give aluminum in solution at a pH value as high as 5.0 and slightly above. Therefore, the soil on which the lime experiment was conducted is one in excellent condition for the production of potatoes. Data on the solubility of aluminum in these soils, while it was comparatively low for the low pH value found,

TABLE 7.—*The influence of calcium and magnesium lime upon the yield of prime Irish potatoes*

1000 Pounds*	1932			1933			1934			1935		
Treatment	Bu. Per Acre	Per Cent Increase	Mean pH at Harvest	Bu. Per Acre	Per Cent Increase	Mean pH at Harvest	Bu. Per Acre	Per Cent Increase	Mean pH at Harvest	Bu. Per Acre	Per Cent Increase	Mean pH at Harvest
No lime	98		4.6	179		4.5	232		4.4	239		4.3
Calcium lime	109	11	5.1	206	15	4.9	320	38	4.6	289	21	4.8
Dolomitic Lime	114	16	5.0	204	14	4.9	379	64	4.7	293	23	4.9
2000 Pounds												
No lime	104		4.6	192		4.5	258		4.4	247		4.2
Calcium lime	120	16	5.3	222	15	5.0	331	28	4.9	300	21	4.7
Dolomitic Lime	128	24	5.5	228	19	5.2	363	41	4.9	318	29	4.7

*Equivalent to 1000 pounds of calcium carbonate with a second application October, 1934.

showed that the no-limed plats gave slightly more than 3 times the quantity of soluble aluminum found in the limed plats.

A significant change in fertilizer materials has been made in the past year or so. For example, many fertilizers prior to this change were distinctly acid forming (16, 17, 18, 23) in the soil. Some of these mixtures developed enough acid to require as much as 300 to 400 pounds of calcium carbonate per ton of fertilizer for its neutralization. The average probably ran between 150 to 200 pounds. This, together with leaching of calcium and magnesium, made it necessary to add between 500 to 600 pounds of lime each year to maintain the reaction of the soil somewhat constant. Many potato fertilizers on the market now have had enough dolomitic lime added to neutralize the acid developed in the soil. This is a distinct change and warrants the consideration of the grower in his liming practice. While the present fertilizer is new and field tests with these new products are somewhat limited at this date, the idea is supported by good sound reasoning and will no doubt prove very beneficial.

LITERATURE CITED

(1) Bear, F. E., and Allen, L. 1932. Relation between fineness of limestone particles and their rates of solution. Ind. and Eng. Chem. 24:998.

(2) Blair, A. W., and Prince, A. L. 1934. The influence of lime on the reaction of subsoils. Jour. Agr. Res. 48:469-473.

(3) Carolus, R. L. 1933. Some significant variations in the chemical composition of the plant associated with a malnutrition trouble of potatoes. Amer. Pot. Jour. 10:147-165.

(4) Eddins, A. H. 1934. Effect of inoculated sulphur, lime, and mercury compounds on the yield of potatoes. Amer. Pot. Jour. 11:295-302.

(5) Hardenburg, E. V. 1932. Potato growing in New York. Cornell Univ. Agr. Exp. Sta. Ext. Bul. 239.

(6) Hester, J. B. 1933. The effect of soil type, soil acidity, and organic matter on the growth of beets, the solubility of aluminum, and the availability of plant nutrients. Amer. Soc. Hort. Sci. 30:460-464.

(7) ———. 1934. Micro-chemical soil tests in connection with vegetable crop production. Va. Truck Exp. Sta. Bul. 82.

(8) ———. 1934. The influence of lime upon soil reaction and yield of Irish potatoes. Trans. Peninsula Hort. Soc. 24:45-51.

(9) ———. 1934. The amphoteric nature of three Coastal Plain soils. I. In relation to plant growth. II. In relation to the leaching and absorption of soil constituents by plants. Soil Sci. 39:237-254.

(10) ——— and Shelton, F. A. 1933. Seasonal variation of pH in field soils as a factor in making lime recommendations. Jour. Amer. Soc. Agron. 25:299-300.

(11) ——— and ———. 1934. Comparative data for three Coastal Plain soils for soil characteristics and plant growth. Va. Truck Exp. Sta. Bul. 84.

(12) Langworthy, C. F. 1917. Potatoes, sweet potatoes, and other starchy roots as food. U. S. D. A. Bul. 468.

(13) MacIntire, W. H., and Shaw, W. M. 1930. Lime-magnesia ratios in dolomitic limestones as influencing solution and soil reactions. Jour. Amer. Soc. Agron. 22:14-27.

(14) Martin, W. H. 1922. Potato scab and methods for its control. N. J. Agr. Exp. Sta. Cir. 131.
1920. The relation of sulphur to soil acidity and to the control of potato scab. Soil Sci. 9:393-408.
1921. A comparison of inoculated and uninoculated sulphur for the control of potato scab. Soil Sci. 11:75-85.
1922. Potato fertilizers bear relation to scab. Hints to Potato Growers Vol. 3:No. 7.
1923. Potato scab and the weather. Hints to Potato Growers Vol. 4:No. 4.
(15) ———. 1930. Soil reaction and the potato crop. Hints to Potato Growers. Vol. 11:No. 7.
1932. Avoid excessive soil acidity. Hints to Potato Growers 13:No. 5.
(16) Mehring, A. S., et al. 1934. Changes in composition of American fertilizers, 1880-1932. U. S. D. A. Cir. 315.
(17) Pierre, W. H. 1934. A review of studies concerning the residual acidity of mixed fertilizers. Commercial Fertilizer Yearbook, 1934.
(18) ———. 1928. I. Effect of various nitrogenous fertilizers on soil reaction. Jour. Amer. Soc. Agron. 20:254-269.
(19) Potato Facts. U. S. D. A. Bureau of Agricultural Economics. 1934. (Mimeographed)
(20) Snyder, E. F. 1935. Methods for determining the hydrogen ion concentration of soils. U. S. D. A. Cir. 56.
(21) Stevens, E. H., and Hearn, W. E. 1917. Soil survey of Accomac and Northhampton counties, Virginia. U. S. D. A.
(22) Wessels, P. H. 1932. Soil acidity studies with potatoes, cauliflower, and other vegetables on Long Island. Cornell Univ. Agr. Exp. Sta. Bul. 536.
(23) White, J. W. 1931. The effect of ammonium sulfate on soil reaction. Jour. Amer. Soc. Agron. 23:871-877.
(24) ——— and Gardner, F. D. 1918. The relative value of limestone of different degrees of fineness for soil improvement. Pa. Agr. Exp. Sta. Bul. 152.
(25) Zimmerley, H. H., and Brown, B. E. 1931. Fertilizer ratios of ammonia, phosphoric acid, and potash for potatoes. Va. Truck Exp. Sta. Bul. 77.

HOW TO GET FAIR PRICES FOR THE LATE CROP OF 1935

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Now that the Warren Potato Act has been passed, the potato growers in the 32 late potato growing states have two courses of action if fair prices for their potatoes are to be realized this season.

The Warren Potato Act will not control potatoes that are harvested before December 1st, 1935. Since practically all the potatoes grown in the late states will be harvested before this date, there will be no control for late potatoes until the fall of 1936.

Based on the August, 1935 estimate of potatoes produced, the crop in the 32 late states is 314 million bushels. This quantity is only 8 million bushels less than these states produced in 1934. If something is not done, we can expect prices almost as low as we experienced during the last twelve months.

We have two courses of action. The first we must do for ourselves, namely, create a wave of enthusiastic determination that we can and will get a fair price for potatoes. This can be done because we are entitled to it and the situation is such that we can get a fair price.

The second course of action may be accomplished while the first is being done, namely, show the Secretary of Agriculture that we want the interstate movement of potatoes controlled. This may be done under the amended Agricultural Adjustment Act just passed. We should attempt to get this control as a part of our campaign to get a fair price. We can get a fair price if either of these plans is carried out but we should plan to do both as a matter of safety.

Conditions are such this year that if the potato growers make up their minds that they are going to get a fair price, they will get this price. United effort by less than half the growers will accomplish this. The dealer makes his decision as to the probable level of potato prices almost entirely from the estimated production. There is a vast difference between the estimated production and the quantities that are actually sold. Out of one million bushels estimated to be produced in some states, only 160,000 bushels are sold. In other states, out of one million bushels estimated produced, as much as 930,000 bushels are sold. Since the quantity that is sold or offered for sale is very important, the grower should use these figures.

If the 32 late states, based on the August 1st estimate, sell every potato that is suitable for sale, they will have only 200 million bushels. The other 114 million bushels include culls and shrinkage or are used for food for the family, seed and feed for livestock. This figure of approximately 114 million bushels is fairly constant and there is very little variation from year to year. Culls and No. 3's would have to be sold to increase the salable quantities from the late states to over 200 million bushels.

The Warren Potato Bill has provided us with a yardstick for measuring the quantity of potatoes that may be sold so that a fair price to producer and consumer may be realized. This quantity has not yet been determined by the Department of Agriculture but by studying carefully the last six years, comparing the quantities that were sold or offered for sale in the low-priced years with the quantities sold or offered for sale in the years when prices were fair, we can roughly say that the parity quantity as determined under the Warren Potato Bill will be close to 225 million bushels. This means that the 32 late states will have a parity quantity of approximately 190 million bushels. This is the quantity that the late states will be able to sell tax free un-

der the Warren Potato Bill. This is the quantity that can be sold this year if fair prices are to be realized.

Using the average percentage of potatoes sold by each state in the last six years, we can figure approximately the amount each state will have for sale from the crop that they are now harvesting. As the September, October and final estimate is changed, we will have to change our figures accordingly; but based on the August 1st estimate, we can figure that the 32 late states will have approximately 200 million bushels for sale. If we attempt to sell all of these, we will receive a price of about 39 cents a bushel which will mean a return of about $78,000,000. On the other hand if the growers are determined to get a fair price, they will sell 190 million bushels and will receive an average price of approximately 69 cents a bushel which will bring $130,000,000. If we get this additional $52,000,000, it will bring the price of potatoes near the average cost of production. If we don't get it, it will mean that we shall lose just as we did in 1934-'35. The difference in price to the consumer will be almost nothing and there will be no justified consumer resistance.

Last year the excess production was concentrated in the states of Maine, New York, Pennsylvania, Michigan and Wisconsin. This made such an exaggerated condition in the east that it caused low prices everywhere. This year the situation is more hopeful. The ten million bushel surplus is spread almost evenly between the east, central and western states. This situation is both dangerous and hopeful. It is dangerous because all important states have a small surplus and there are no important shortages anywhere. Under these circumstances, if something is not done to counteract it, the tendency will be towards a gradual decline in price until finally a very low level is reached. It usually takes a shortage in two or three states to start a wave of increasing prices which finally makes itself felt in the states that have a surplus. This condition will not prevail during the present year, but if something is not done, we can expect the dealers and the large chain store operators to say to themselves that they will get all the potatoes they want, and at their own price.

If the farmers in the late producing states would insist on a fair price for their crop they could unquestionably get it. The two states that will suffer most are New Jersey and California since they have already sold so many of their potatoes that the average for neither of these states can approach the cost of production. It is certain that fair prices will be realized if a group of determined farmers in each state make up their minds that they are going to get these prices. There

is nothing in the situation this year that warrants any fear of what another state might do, nor is there need of fear on the part of any individual grower concerning his neighbor's actions.

It is true there are a number of difficulties in connection with a plan of this type, such as the need of selling potatoes for financial reasons, the need of selling because of lack of storage room and various other reasons. These difficulties always occur and they make themselves felt. The important thing to remember is that the general level of potato prices results from what a large group of men think it should be. In the past the dealer has always predominated and has imposed low prices on the grower whenever a surplus existed. This year 40 per cent of the large growers will be able to overcome the combined determination of the dealer to force the price down, by demanding a fair price and making a fight for it.

From a strictly practical viewpoint, the proposed plan need only be enforced in the states of Maine, New York, Pennsylvania, Michigan, Wisconsin, Minnesota, North Dakota, Nebraska, Idaho and Colorado. Every state outside of those mentioned will either be short of potatoes this year or produce so small a quantity that their volume will not be consequential. The facts are that Maine, New York and Pennsylvania may get together and by determining to get a fair price, will get it if no other state makes a move and it would take only a few farmers in these three states to accomplish their objective. Likewise, Michigan, Wisconsin, Minnesota and North Dakota can do the same thing. These states are more dependent on what the other states do but it may be definitely stated that a wave of enthusiasm in these states would be productive of better prices.

In the western states, the situation is comparatively simple. The surplus of California was marketed during the months of June and July. Oregon and Washington, according to the August 1st estimate, will produce less potatoes than they can sell. The only surplus in the west will be produced in the states of Idaho, Colorado and Nebraska. These three states will experience very low prices this year unless something is done. It can be safely predicted that the average in these states, if nothing is done, will be the lowest of any state in the United States. These three states have the greatest possible increase to gain and it will be well worth attempting something.

If none of the other states do anything, it still is possible for the state of Idaho to act by itself. If the August 1st estimate is borne out this year, Idaho will have 18 million bushels of potatoes for sale. If Idaho attempts to sell more than 18 million bushels, it will lose all the

premium it will get because of superior quality. It can be safely said this year that if Idaho, acting alone, were to sell only 14 million bushels of potatoes, a price of 75 cents a bushel would be realized as opposed to an average of 30 cents a bushel on 18 million bushels.

Farmers in every producing district should hold meetings and become thoroughly familiar with the facts and figures of the potato situation. When these are understood, they will quickly arrive at the conclusion that they can get a fair price for their potatoes and sell just as many at a reasonable price as they will sell at a low price. With the Warren Bill as a background and the early and intermediate crop controlled; with only a small surplus to deal with, and this spread evenly over all sections of the country, all the grower needs to do is to overcome the attitude of the dealer. The dealers, as a group, are as changeable as an aspen leaf and when certain that a determined effort is being made to raise the price they will join the movement.

While all this is being done, the growers may resort to the second plan of action. The amended Agricultural Adjustment Act provides that if two-thirds of the growers on a volume basis in any region, on proper showing, request the Secretary of Agriculture to "issue orders" on their commodity, the Secretary of Agriculture must do so. The law gives the Secretary of Agriculture the right to limit the quantity of potatoes moving in interstate commerce. If the states that produce the excess this year were to form themselves into a region, they could control the quantity of potatoes moving in interstate commerce.

The states that should do this are Maine, Michigan, Wisconsin, Minnesota, North Dakota, Nebraska, Idaho and Colorado. These eight states, by cutting 10 million bushels from the amount that they would ordinarily ship in interstate commerce, would increase their revenues by $30,000,000. These states could remove 10 million bushels that move in interstate commerce by only shipping the good potatoes that they grow. The culls and poor potatoes that they now sell, whether they are mixed in with the good ones or whether they are shipped as poor grades, bring the producer almost nothing.

These states could curtail their shipments by 10 million bushels, without any fear that this curtailment would be offset by increased shipments from home-grown potatoes. The statistics of the United States Department of Agriculture for the 66 large cities in the United States, embracing 32 million people show that these cities used 75 million bushels of potatoes during the year 1931 in addition to the potatoes that were grown in the states where the city was located.

These records are kept for only 66 cities. There are approxi-

mately 600 principal cities in the United States with a total population of nearly 68 million. This means that the cities could use every potato grown in the state where the city is located and would still need 120 million bushels that must move in interstate commerce.

The entire quantity of potatoes that the excess producing states need move in interstate commerce is less than 123 million bushels. It can be definitely stated that if the movement of potatoes is limited to 90 per cent of the quantity that the excess states must move; this quantity will be consumed by the cities in the United States, irrespective of the quantity received from home-grown supplies.

All of us know that the price of potatoes is determined by the price set in the large cities. The prices in New York, Chicago, St. Louis, Kansas City, New Orleans, San Francisco and Los Angeles greatly influence the general price level. Figure for yourself the quantity of potatoes that these cities can get that are grown in their own states and then estimate how many they must get by interstate commerce. New York City is probably the most interesting example. New York, in 1931, unloaded 16,772 cars from interstate shipment. This is almost 10 million bushels of potatoes. If New York City had used 10 million bushels of potatoes from the production of New York State in 1931, there wouldn't have been many potatoes to feed the rest of the state and this would necessitate resorting to interstate shipment for their supplies. In 1931 Chicago used 16,000 cars which again is 10 million bushels. The state of Illinois in 1931 had for sale only 77,000 bushels, so that Chicago is always dependent on interstate movement. This is true for the majority of large and small cities.

There is another distinct advantage in attempting to control the interstate movement of the late crop of 1935. The situation is such that this attempted control can be accomplished without fear of greatly disturbing normal marketing conditions. It will also give the Agricultural Adjustment Administration a measure of quantities actually being sold and will enable them to administer the Warren Potato Act more accurately. More than all this, there is always the chance that portion II of the Warren Potato Bill, which provides for control through taxation, may be found unconstitutional. If this happens, the potato farmers can always fall back on that part of the Act which provides that the interstate movement of potatoes can be legally controlled. This amendment to the Agricultural Adjustment Act was written in order to stand the test of constitutionality and it is believed that it will do so.

If interstate control is used immediately it will prepare the way

for control in subsequent years and the machinery necessary for its administration will have been pioneered. So taking everything into consideration, it seems to be indicated that if the growers of late potatoes are to get a fair price for their crop, they should declare themselves and get machinery under way so that the attempt can be made. The grower of late potatoes has everything to gain and nothing to lose. It is only a matter of acquainting the growers with the proposition and getting them to declare themselves.

POTATO SOIL FERTILITY AND FERTILIZER LITERATURE FOR 1934[1]

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This review of literature summarizes very briefly publications that have come to the attention of the writer during 1934 bearing upon the related subjects of soil fertility, fertilizers and soil amendments as applying to the potato crop.

The importance of magnesium as an essential nutrient element, and how best to supply the needs of the potato crop when it is deficient in the soil, is discussed in several publications which have appeared during the current year, (2, 5, 6, 15, 16).

Fertilizer placement studies to determine the best location of fertilizer in reference to the germination, growth and yield of potatoes were conducted in 1933 in Maine, Michigan, New Jersey, Ohio and Virginia on important potato soil types (3, 7, 19). Reports covering 1933 studies were presented before the Joint Committee on Fertilizer Application in Chicago, November 15, 1933. A general summary of the 1933 work was published in the American Potato Journal. Results of fertilizer placement studies made in 1934, with the addition of an experiment on Long Island, were reported at the Tenth Meeting of the Joint Committee on Fertilizer Application held at Washington, D. C., on November 21, 1934. Results obtained in 1934 again indicate that placement of the fertilizer in narrow bands on a level with and about 2 inches from the seed piece gave best results.

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1. For incorporation with a general review of literature covering potato investigations reported in 1934.

2. Division of Soil Fertility Investigations.

The use of fertilizers and green manure crops in potato production have received attention during 1934 (4, 14, 24). In Ohio, John Bushnell reports that "from the evidence at hand it seems to be a practical procedure to use non-legumes as green manures for potatoes. Non-legumes can be grown on soils at pH 5.5 or lower, more successfully than legumes. The use of non-legumes, such as corn, is advocated where legumes have failed to maintain the soil in proper physical condition, or where legumes do not thrive because of the soil reaction, or where wireworms have appeared because sod or small grains were part of the rotation." On Long Island, P. H. Wessels, in reporting on fertilizer studies with potatoes, gives 5 years' results from the use of various applications of nitrogen, phosphoric acid and potash on the yields of Green Mountains. The data indicate that acre applications of 60 pounds of nitrogen, 115 pounds of phosphoric acid and 60 pounds of potash proved best.

Results showing the influence of different fertilizer treatments, chiefly rate of application and varying nitrogen and potash sources, on total solids, starch and sugar content, and on yields and loss of weight in storage, are reported (22) from Alabama.

Certain experimental studies in the southwestern section have dealt more with duty of water studies in relation to soil type and variety than to fertilizer usage (10).

The influence of soil factors, chiefly soil temperature and soil moisture, affecting potato seed piece decay in the Spokane Valley is reported by Vincent and Pawson of Washington (21).

Results following side dressing of fertilizer materials to the potato crop at different stages of growth and the scope of potato fertilizer experiments in 1934 have been reported from New Jersey (17, 18).

The dividing line between primes and seconds according to weight has been determined for the Irish Cobbler in connection with certain detailed weight and measurement studies of tubers from individual hills (12).

A discussion concerning the effect of soil fertility and fertilizer application on optimum spacing of potato seed pieces is presented in connection with certain studies in Washington and on Long Island (14, 23).

The use of rapid soil tests for diagnosing soil conditions and as a means of estimating the available supplies of nutrient material in soils is discussed in two papers appearing during 1934 (13, 20). These tests are receiving a considerable amount of attention on the part of soil

workers in attempting to diagnose the fertilizer requirements of different crops.

Soil management and fertilizer problems related to production of potatoes on muck land in New York have been reported in 1934 (11). E. V. Hardenburg, reporting on muck land potato production in New York states that "last year over 6,000 acres of potatoes were grown on muck soil in New York. This is nearly 3 per cent of the total potato acreage in the State," and reports also that, "The acreage of muck potatoes is increasing annually." Better production and handling methods are insuring potatoes of better quality. The selection of good quality muck for potato production is essential. The fertilizer practice to follow on both new and cropped muck land is discussed on the basis of experimental results.

The effect of certain soil amendments applied at different rates including inoculated sulphur, lime, and certain mercury compounds on potato yields has been studied under Florida conditions at several locations (8). A. H. Eddins, Florida Agricultural Experiment Station, comparing different rates of sulphur, 200, 400, 600, 800 and 1,200 pounds per acre, found that the soil became more acid and the increase in acidity was correlated with reductions in yields. The greatest increase in acidity which resulted in lowest yields followed the heaviest applications of sulphur, reaching a point where there was a reduction of 33 barrels per acre. Lime reduced soil acidity but the yields were not materially affected. According to the writer, "Calomel and yellow oxide of mercury applied to the soil with the fertilizer at the rates of 5, 10, and 20 pounds per acre, respectively, usually caused marked reductions in yields, the greatest reductions resulting from the heaviest applications." Certain commercial preparations produced only slight yield differences, some being reductions rather than increases.

A field comparison of nitrogen sources including urea, ammonium chloride, ammonium nitrate, ammonium phosphate and other nitrogen compounds on prominent soil types in New York, Pennsylvania and Virginia has been reported (1). The results presented by B. E. Brown, G. V. C. Houghland and F. R. Reid show that generally the newer nitrogen materials are comparatively good sources of nitrogen for potato fertilizers in ordinary mixtures.

A discussion of potato fertilizer plots in Iowa is presented in the Iowa State Horticultural Society Report for 1934 (9).

1. Brown, B. E., Houghland, G. V. C., and Reid, F. R. 1934. Sources of nitrogen for potato fertilizers compared on prominent soil types in New York, Pennsylvania and Virginia. (Unnumbered Pub.) 19 (mimeographed).

2. ———. 1934. Magnesium deficiency in certain soil types reduces potato yields. U. S. Dept. Agr. Yearbook, 258-261.
3. ——— and Cumings, G. A. 1934. Fertilizer placement studies with potatoes in 1933. Amer. Potato Journal, 11:265-273.
4. Bushnell, John. 1934. Green manures in potato rotations. A preliminary report. Amer. Potato Journal, 11:117-122.
5. Carolus, R. L. 1934. Some factors affecting the absorption of magnesium by the potato plant. Amer. Soc. Hort. Sci. Proc. (1933), 30:480-484.
6. Chucka, Jos. A. 1934. Magnesium deficiency in Aroostook soils. Amer. Potato Journal, 11:29-35.
7. ———. 1934. Fertilizer placement studies on potatoes in Maine, 1932 and 1933. Amer. Potato Journal, 11:95-98.
8. Eddins, A. H. 1934. Effect of inoculated sulphur, lime and mercury compounds on the yield of potatoes. Amer. Potato Journal, 11:295-302.
9. Fitch, C. L. 1934. Potato fertilizer plots, 1933. Iowa State Hort. Soc. Rpt., 68:267-269.
10. Garcia, F., and Young, S. C. Irish potato experiments. New Mexico Bul. No. 218.
11. Hardenburg, E. V. 1934. Muck land potato production in New York. Amer. Potato Journal, 11:244-246.
12. Houghland, G. V. C. 1934. The minimum weight of a prime potato. Amer. Potato Journal, 11:205-206.
13. Morgan, M. F. 1934. Soil testing as a guide to sound soil management. Amer. Potato Journal, 11:259-265.
14. Jensen, Harry J., and Morris, O. M. 1931. Potato growing in the irrigated districts of Washington. Washington Sta. Bul. 246:30
15. Knoblauch, H. C., and Odland, T. E. 1934. A magnesium deficiency induced by previous fertilizer treatments. Journal Amer. Soc. Agronomy, 26:609-615.
16. Knoblauch, H. C., and Odland, T. E. 1934. The response of potatoes to magnesium under various soil conditions. Amer. Potato Journal, 11:35-40.
17. Martin, Wm. H. 1934. Side dressing experiments. Hints to Potato Growers, 14:11.
18. ———. 1934. Potato experiments in 1934. Hints to Potato Growers, 14: 12.
19. Proceedings of the Ninth Annual Meeting of the Joint Committee on Fertilizer Application. Held at Chicago, Ill., Nov. 15, 1933. Published and distributed by the National Fertilizer Association. Reports of station coöperators embodied in Proceedings.
20. Spurway, C. H. 1934. The use of rapid soil and plant tests in teaching, research, and extension work. Amer. Potato Jour., 11:95-98.
21. Vincent, Chester L., and Pawson, Walter W. 1933. Factors affecting potato seed piece decay. Amer. Soc. Hort. Sci., 30:491-495.
22. Ware, L. M., and Kimbrough, W. D. 1933. Influence of different fertilizer treatments on certain characteristics of the Irish potato. Amer. Soc. Hort. Sci. 30:485-490.
23. Wessels, P. H. 1934. Influence of the level of fertility on the optimum spacing for potatoes. Amer. Potato Journal, 11:17-20.
24. ———. 1934. Fertilizers for potatoes. Amer. Potato Journal, 11:65-69.

SECTIONAL NOTES

IDAHO

We are having a rather unusual infection of the vascular tissue of potato stems which is sufficiently severe in some districts to reduce the crop by 50 per cent. In fact, many fields of Gems which were planted in the latter part of April and early May with the intention of catching the early market are now entirely down, largely

because of this vascular infection. We are not sure of the causal organism but suspect that it is probably Fusarium. This trouble seems to be largely the result of, or associated with, potato growing on the same land without an intervening crop of alfalfa or clover. Just how much this will affect our yield in Idaho is problematic, but I think without question it will cut us down to a million bushels.

So far, frost has not materially interfered with our crop. The Northern part of the state was severely frosted the night of the 14th and 15th of August, but this did not reach our Snake River district to any considerable extent. At present, potatoes are doing well, except for the effects of this vascular infection trouble.

There is another condition which is more or less prevalent in some fields. While it is not new, it is sufficiently marked this year to draw attention to it. This presumably virous disease, when attacking potatoes early in the season, causes dwarfing of the plant, with a distinct distortion of the leaves, which become thickened, curled, and fasciated. Most plants are of a distinctly yellowish-green color.

In some fields we find a few dwarfed plants, and on plants that were presumably normal until the past few weeks, the growing tips have taken on this appearance. Metzger of Colorado, who was recently with me in the fields in the Twin Falls district, tells me that he and Harrington found the same thing in Montana and that Harrington is calling it "Haywire". Maybe this is a Western expression, but it is quite applicable, inasmuch as some of the plants that have apparently recently become infected go "Haywire" very rapidly.

I would like to know if this trouble is prevalent in other districts of the country. So far, we have noted it only on our Netted Gems, but it might have attacked other varieties, causing them to show rather different symptoms from this variety.

The prospects are now that we will have a crop of potatoes in Idaho that will be much better in quality than that of last year, but I rather suspect that our present yield estimate is high by one or two million bushels. (Sept. 12).—E. R. Bennett.

INDIANA

The big question at this time is what will the Warren Potato Bill do to the market and to the acreage in Indiana for another year. It is anticipated that these questions will be answered at the time of our potato meeting which will be held in connection with the

Northern Indiana Muck Crops Show at North Judson, Indiana, on November 6.

During the last two or three weeks we have had some ideal weather for potatoes. The weather has been cool, and we have had sufficient moisture. Little or no damage has resulted from leafhopper injury and the vines are green and in a healthy condition. Although we will not dig until the latter part of this month, we anticipate a slightly higher yield than we have had in the past and the condition of the crop is 8 to 10 points above normal. The price of potatoes, however, is just about as usual, with most of the growers getting from $1.00 to $1.25 per hundred weight.

The quality of the early potato crop (mainly Cobblers with a few Ohios mixed in) was very good this year and the yields run approximately 160 to 180 bushels per acres on an average, depending somewhat upon the section in which they were grown. (Sept. 10). —W. B. Ward.

IOWA

Although this state has less potatoes than are needed by its own people, the area is affected by the general damming back of supplies which has continued from early spring until the present time. In the middle of September our shippers paid growers at the car, approximately 60 cents per hundred for U. S. No. 1 Cobblers. Sack lots delivered to stores were bringing about $1.00 in the commercial 1egions. Truck prices were in between, as were prices to growers,—close to the deficiency areas.

Some growers are inclined to expect better prices later and to store until after field shipping is completed in the Northern section. Until that time, at least, our best carlot market will be prior to October 1. We shall not have the remarkable truck trade of last year to the drought areas. Our freight rates to Chicago and St Louis have been raised.

Because of a cool wet June, we had much rotting of seed, much rhizoctonia and black leg and many weak plants. Due to the extreme heat and drought for six weeks following June, slight scabbing and early maturity resulted. Following a series of years of large insect population, both here and in the Red River valley, we have considerable virous diseases.

The supply of seed Cobblers in North Dakota and Minnesota, and in the small areas of Wisconsin which produce this variety, is fair in quantity. We think we should get it F.O.B., their

stations, at about Chicago prices for U. S. No. 1 table stock. Paying the freight is quite a premium for certification. We believe that this bonus, together with their larger yields from certified fields, should look good to northern growers of certified seed.

Last spring, for the first time on record, carlots of Maine-grown table stock and of seed Cobblers were brought to this area. While we have no fault to find with the potatoes, we trust that such a market situation will not recur. (Sept. 9).—C. L. Fitch.

MAINE

Yields are running quite low generally. Growers are now harvesting Cobblers and Bliss. The general report, from every one, is that the crop will be the smallest for many years. One grower has stated that in the thirty-one years of his farming this year's yields are the lowest on record. His yields are running considerably higher than the average.

The quality is excellent. It is doubtful if Maine ever harvested a better crop of Cobblers, than it is securing now. The size runs uniform, type is splendid, and the color and cooking quality very superior.

The shrinkage from seconds will be excessive. Even with the increase of certified acreage over that of last year, the total seed available will run less, in all probability.

No one has harvested late varieties, as yet. Weather conditions have been favorable for the late growth, and the Experimental Station's weekly yield records indicate substantial increases.

The quality of Green Mountains will, also, be better than usual. There is now, apparently, little prospect of second growth, or other factors damaging quality. Probably yields of Green Mountains will run somewhat lower than usual, but there will not be so marked a decrease as is found in Cobblers, because of drought conditions in August.

The Production Credit Association is making splendid progress in their marketing program. Warehouses have been leased at a saving to growers of five to ten cents a barrel over previous charges.

Considerable savings are being made in burlap purchasing, insurance protection, and other activities. The cost of storing, and grading the crop under their control, will probably be about 60 per cent of normal. It is proving to be a splendid example of what can be accomplished by organized, well-directed and intelligent effort.

With the great amount of tonnage in the hands of Aroostook

Production Credit Association, and with considerable decrease in total production in the Northeast over last year, Maine growers are confidently placing most of their crop in storage. (Sept. 14).—Frank W. Hussey.

Dry weather prevailed during July and the first 20 days of August. For two weeks in the middle of August it was very hot, many residents saying that it was the driest and hottest weather they ever experienced in their county. There were light rains during the last ten days of August and on September 5th the drought was definitely broken.

As a result of the unfavorable conditions, the Cobblers made a poor growth and all of them were prematurely dead in August. The yields of the Cobblers will range from 50 to 100 bbls. per acre field run. Last season yields of 150 bbls. or more per acre were very common. This season the potatoes will run to small sizes.

South of Mars Hill, west of Presque Isle and Caribou and north of Caribou, comprising more than half the area of Aroostook County, the Mountains show the lack of fertilizer and are injured beyond recovery. In the central section between Mars Hill, Presque Isle, Caribou, Fort Fairfield and Limestone, the crop is still green and will approach an average crop if frost appears late. An early frost would make a great difference.

The Central Maine crop, comprising 20 per cent of the total for the State, is very poor, injured beyond recovery. It now looks as if the crop for the State would be from 60 to 70 per cent of last season's big crop depending on when a killing frost comes. (Sept. 10).—H. R. Talmage.

MASSACHUSETTS

The early Cobbler crop is practically harvested and mostly moved to market, with farm prices ranging from 60 cents a hundred for earlier sales to $1.15 for later sales. Yield of Cobblers has been, in general, slightly above last season with the better crops running approximately 300 bushels per acre.

Digging of the Mountain crop is now in progress. From present indications the yield may be relatively poorer than last season as the set and size runs smaller, because of insects, heat and dry weather.

Hot days during the setting period of the Mountain crop, followed in August by dry weather, affected many crops. The appearance of tubers also has been affected this season by flea beetle injury, and somewhat more rhizoctonia than usual. Blight has not yet been prevalent to any extent.

While some well-sprayed fields of Mountains are still green, some secondary setting and growth may yet develop on these fields because of recent rains. Risk of blight in such cases is sufficient reason for spraying operations to continue among some of the better growers. (Sept. 14).—Ralph W. Donaldson.

NEBRASKA

The condition of dry land crops in western Nebraska at this time is better than it was at the same time a year ago and has improved somewhat over the condition of a month ago. Light rains have fallen in this region and over all the territory during the last two weeks. Though these rains were accompanied by light frosts in a portion of the territory, not much damage was done. A year ago at this time our crop was frozen to the ground and the average production was approximately 25 bushels per acre on dry land fields and 150 bushels on irrigated fields. This year I believe we will approach the average which is about 100 bushels per acre on dry land fields and 300 bushels on irrigated fields. The usual frost date is September 25th and if we have favorable growing conditions to that time, we will probably have normal yields in both dry and irrigated sections.

Prices have been uncertain and shipment to date has been rather light. Table stock prices have ranged from 40 cents to 60 cents per hundred weight, f.o.b. shipping point. These prices are to the grower.

Owing to the extreme drought, the dry land area planted was somewhat reduced, but the irrigated area increased sufficiently to off-set the decrease. At this time we anticipate an average production but the quality will probably be poorer than usual owing to several factors. One factor that usually enters is the extreme heat followed by moist, cool weather which causes a number of off-type potatoes. Another trouble has come into the territory this season with which we have not been troubled in the past to any great extent and that is the infection of Psyllid Yellows. In some areas this disease will reduce the yield very materially, and in other areas the yield will not be affected but the quality will be very materially affected. In the past insects have been very sporadic in occurrence, but this is probably one of the worst seasons on record.

It is rather difficult to decide how the new potato legislation is going to affect us. Growers are, for the most part, in a quandary as no information is available. It might be said that a great deal of misinformation is being spread around that is unfavorable to the

legislation. We feel that the growers will probably refrain from committing themselves until they receive some information concerning the Legislation. In all probability it could be said at this time that those growers who have made up their minds definitely are in favor of potato control. (Sept. 14).—Marx Koehnke.

NEW JERSEY

The Potato Sales office was closed on Sept. 14. The remainder of the New Jersey crop will be sold from the individual dealer's offices. It is estimated that approximately 24 per cent of the crop remains to be sold. At the present time the growers are receiving 65 cents a hundred for graded, sacked potatoes, at the barn. (Sept. 17).—Wm. H. Martin.

PENNSYLVANIA

Some sections were very dry during August. This was doubly injurious following the wet weather earlier in the season. The eastern potato section suffered from continued heat. In the mountain sections, blight has been severe and extremely difficult to control. This, coupled with the generally poor job of spraying, because of general discouragement, has resulted in great damage. As a result of the wet weather in June and July potato fields are very weedy. Very heavy and continued rains during the first week of September in the eastern part of the state damaged many promising fields and may cause objectionable second growth where the tops are not already dead. Yields of Cobblers in well-tended fields have been good, but prices have been discouragingly low. (Sept. 11).—J. B. R. Dickey.

SOUTH DAKOTA

Conditions in the South Dakota potato growing section have been rather unfavorable to the crop for the past month. It has been extremely dry, and at the present time temperatures are quite low. The result will be that the crop is not maturing normally. It appears as if most of the crop will be marketed locally. As a matter of fact, the yield expected will be so low that only local demands can be satisfied. (Sept. 12).—K. H. Klages.

VIRGINIA

The experts of the potato industry and the economists who forecasted potato prices this year in the Virginia area were about on a par with the industrial economists in their forecast of the continuation of the 1929 prosperity.

The acreage planted and the yield forecasted in the area from Virginia, south, really indicated a fair price for potatoes. Even through the shipping season of North Carolina, when the flow of old potatoes pushed the price level much below previous expectations, it was believed that a price rebound would occur for the benefit of the Virginia growers. This expectation continued when the Virginia season opened, and until it reached its peak.

Hope dies hard. No one would believe that old potatoes from Maine, Michigan, Wisconsin and elsewhere would continue to reach the market at so ridiculously a low price, or that the so-called deficiency states of Pennsylvania, New York, etc., would take potatoes from thousands of cellars and sell them on all their local markets from 20 to 25 cents a bushel delivered, until July had well run its course.

The excessively large new crop from California crippled the Midwestern markets. In addition the increased development of early production in a broad belt extending from northern Maryland well up into New York and even in Canada around the Toronto district, and extending east and west from the Connecticut Valley almost to the Pacific Coast, has reached such proportions that the local markets are well supplied from relatively early in July. This limits the demand from the large southern commercial sections. This is a development that has been increasing rapidly and, no doubt, will assume even greater importance in the future.

Coupled with the small, weak demand at ridiculously low prices was a local development generally called a "Growers' Strike", wherein many growers, under local leadership, caused a cessation of potato shipments unless the potatoes were sold at a fixed price,—this price being higher than that justified by market conditions. This undertaking largely stopped the movement of potatoes from the Virginia and the Eastern Shore of Maryland districts during the usual peak movement. This resulted in deterioration of the stock, heavy demurrage on the goods which were on track and the inability to move the crop during the normal Eastern Shore season. The net results show the futility of local price-fixing attempts, which continually arise from year to year and end in a lessened return to the man who produces the potatoes. The outcome surely indicates that the fundamentals governing price are more largely determined by supply, rather than by local competitive factors, and definitely prove that the industry is too broad, too widespread and in too many hands for any small local area to effect any outstanding salvation by price fixing.

(Sept. 7).—G. S. Ralston.

American Potato Journal

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THE POTATO ACT OF 1935

Much mis-information has been printed concerning the potato control act of 1935. So much has been said of the iniquities of the measure that a strong opposition has developed. Threats of bootlegging and tea parties with the potatoes as the pièce de résistance, have been rampant. Efforts have been made to raise the consumers' ire and, unfortunately the lowly spud is now in politics.

In the past those interested in the potato have deplored its lack of publicity. All will regret, however, the very undesirable publicity the potato has received the past few months. It is questionable if this will benefit the industry. In some quarters the opinion is held that it might result in consumer reaction which may in turn result in a reduction in consumption even below the present trend. All acquainted with the condition of the growers in the important potato growing sections are agreed that the price situation must be improved. It is essential, however, that this be accomplished without antagonizing many of the growers as well as the consuming public.

The recent Washington hearing indicates that the potato control act is to be carried out. Certain changes have been suggested by the Potato Program Development Committee. These include: an increase in the present exemption of five bushels to 50 bushels; exclude the consumer from the penalty provision with reference to packaging and the affixing of stamps to packages; permit the growers who sell direct to the consumer to file returns rather than attach stamps; consider an amendment by which the shipping of potatoes in interstate commerce in excess of grower allotments could be regulated, and finally, it was suggested that a referendum should be conducted for the allotment year beginning December 1, 1935, after the growers have been fully advised concerning the provisions of the act.

The adoption of these changes would eliminate many of the present objections to the control act and would make its enforcement much simpler. Growers interested in a control program should insist that these changes be made.